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The role of pre-performance and in-game emotions  
on cognitive interference during sport performance: The moderating role of self-confidence  
and reappraisal

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**Abstract**

In this research we examined whether prevalent pre-performance (Study 1) and in-game (Study 2) emotions were associated with cognitive interference (i.e., thoughts of escape, task irrelevant thoughts and performance worries), and whether any effects were moderated by reappraisal and self-confidence. In Study 1, we found team sport players' *pre-performance* anxiety positively, and excitement negatively, predicted cognitive interference during a competitive match. However, no moderating effects for reappraisal or confidence were revealed. In Study 2, we found that badminton players' *in-game* anxiety, dejection and happiness positively predicted, whereas excitement negatively predicted, cognitive interference during a competitive match. Moreover, reappraisal and confidence moderated the relationships for excitement and happiness with task irrelevant thoughts. Our findings underscore the role that pre-performance and in-game emotions can play on athletes thought processing during sport performance, as well as highlight the importance of considering self-confidence and reappraisal on the role of in-game emotions on cognitive interference.

*Key words:* concentration, confidence, emotion, emotion regulation, sport performance.

## Emotion and Cognitive Interference

The role of pre-performance and in-game emotions on cognitive interference during sport performance: The moderating role of self-confidence and reappraisal

There is growing research interest on how emotions can influence sport performance (e.g., Campo, Mellalieu, Ferrand, Mertinent, & Rosnet, 2012; Uphill, Groom & Jones, 2014). Given the limits of information processing (e.g., Eysenck & Calvo, 1992), concentration, defined as the focus of mental effort on the task at hand while ignoring distractions (e.g., Schmid & Peper, 1998), is a key determinant of successful performance. However, emotions can influence concentration by affecting cognition and attentional control (e.g., Eysenck, Derakshan, Santos, & Calvo, 2007; Gable & Harmon-Jones, 2010), and pre-performance and in-game emotions have been associated with in-game concentration (e.g., Allen, Jones, McCarthy, Sheehan-Mansfield, & Sheffield, 2013; McCarthy, Allen, & Jones, 2013; Vast, Young, & Thomas, 2010) and attentional processing (e.g., Wilson, Vine, & Wood, 2009). However, research has neglected to examine how emotions experienced before and during performance are linked with specific internal thought disruptions (i.e., cognitive interference), or tested for amenable moderators of such relationships. Such research would guide ways for sport practitioners (e.g., coaches, sport psychologists) to help athletes regulate emotions in preparation for, as well as during, competition.

## Emotions and Cognitive Interference

Though emotion has been conceptualised in various ways, there is some agreement that emotions are conscious or unconscious cognitively appraised responses to an event which “trigger a cascade of response tendencies manifested across loosely coupled response systems, such as subjective experiences, facial expressions, cognitive processing and physiological changes” (Frederickson, 2001, p.218; cf. Jones, Lane, Bray, Uphill, & Catlin, 2005). In many studies unpleasant emotions have been grouped together and regarded as polar opposites of pleasant emotions (e.g., Bolger 1990). However, unpleasant emotions such

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as anxiety and anger can be both facilitative and detrimental to performance (e.g., Eysenck et al., 2007; Lazarus, 2000; Woodman et al., 2009). Accordingly, researchers have begun to investigate how an array of discrete emotions (both pleasant and unpleasant) are associated with performance related outcomes (e.g., McCarthy et al., 2013; Woodman et al., 2009).

Cognitive interference has been used to refer to internal thoughts which can disrupt concentration through task-irrelevant, or self-preoccupied thinking including components of worry about performance (Sarason, Sarason, & Pierce, 1990). Specifically, cognitive interference comprises of three components; performance worries (e.g., “I am concerned about how I am performing), thoughts of escape (e.g., “I want to quit”) and task irrelevant thoughts (e.g., “I wonder what I’m going to do later”) (Hatzigeorgiadis & Biddle, 2000). Studies have found that cognitive interference is associated with higher concentration disruption (McCarthy et al., 2013) and poorer performance in physical tasks (e.g., Young, 2012).

An emotion that has received substantial research interest in sport is anxiety. Anxiety is considered to reflect uncertainty regarding goal attainment and coping which is manifested by feelings of tension and apprehension accompanied by activation or arousal of the central nervous system (Jones et al., 2005; Lazarus, 2000; Spielberger, 1966). It has been summarised to reflect “facing uncertain or existential threat” (Lazarus, 2000 p. 234). Theoretical perspectives to explain the potential effects of anxiety on sport performance generally agree that anxiety affects attention (e.g., Eysenck & Calvo, 1992; Eysenck, et al., 2007; Masters & Maxwell, 2008). For instance, attentional control theory proposes that anxiety causes stimulus driven attentional control to prevail over attentional control that is task goal directed (Eysenck et al., 2007). As such, individuals are more likely to direct attention to potential threats in the environment, are less adept at shifting attention to salient information and less capable of inhibiting pre-potent thoughts whilst performing (Miyake et

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al., 2000). Research has supported that anxious performers concentrate more often on threatening or irrelevant stimuli during a game (e.g., Murray & Janelle, 2003; Wilson et al., 2009) and that pre-performance anxiety is positively associated with concentration disruption (Allen et al., 2013; McCarthy et al., 2013) and cognitive interference (McCarthy et al., 2013).

Though the attentional control theory is focused on how anxiety may influence cognitive processing, it is likely that a range of emotions can affect goal-directed attention (Derekshan & Eysenck, 2010; Lazarus, 2000). For instance, in their *motivational-dimensional model* of affect, Gable and Harmon-Jones (2010) posited that high-approach affective states (e.g., anger, excitement) result in attentional narrowing, whereas low-approach affective states (e.g., dejection/ sadness, happiness) result in broadening of attentional focus. Specifically, positive high-approach affective states (e.g., excitement, desire) are expected to assist in goal-directed cognitions by shutting out irrelevant stimuli. In contrast, positive low-approach affective states (e.g., happiness), which may be helpful for exploratory behaviours, can be maladaptive for goal-directed attention by inducing an “easing back” or conservation of energy that may result in lower goal-directed mental effort. Likewise, a low-approach affective state (e.g., sadness, dejection) will likely result in “low-effort” focus and widening of attentional breadth. Though it is argued that negative affective states high in motivational intensity could be helpful to avoid danger (e.g., fight vs. flight), the implications of narrowed attentional focus caused by high approach affective states (e.g., anger) on goal directed attention in sport is less clear and probably depends on the performance objective. To this end, research would benefit from examining the contribution that prevalent emotions experienced in sport (cf. Jones et al., 2005) differing in valence and levels of approach motivation may have on cognitive interference.

Anger is a negatively valenced high approach emotion that has received much research attention in sport. Specifically, anger is a high arousal emotion that represents a

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response to an event that is perceived as a demeaning offense against me or mine (Lazarus, 2000). Anger can result in aggressive behavior, particularly if accompanied by intentions to harm another person or following provocation (e.g., Isberg, 2000; Stanger, Kavussanu, McIntyre, & Ring, 2016), and has been associated with both poor performance (e.g., Dewar & Kavussanu, 2011) and good performance (e.g., Woodman et al., 2009). The potential reasons for this discrepancy is the sources of information which anger is directed. Based on Lazarus' cognitive motivational relational theory (2000), emotions are guided by a core relational theme and its associated action tendency, and the influence of emotions on performance can depend on a complex relationship between the individual and the situation. Anger has a core relational theme of "a demeaning offense against me or mine" and an action tendency of "a powerful impulse to counterattack" (Lazarus, 2000, p.242-243). Therefore, if anger is directed inwards towards self-blame or to irrelevant information (e.g., on harming an opponent) this is likely to impair performance (e.g., Lane & Terry, 2000). However, as anger is a high-approach emotion, if applied to a task that is cognizant to "lashing out" which is closely aligned to the action tendency of anger (e.g., weight lifting) then this may facilitate focus and tenacity to the benefit of performance (e.g., Lazarus, 2000; Rathschlag & Memmert, 2013; Woodman et al., 2009). Given these potential differences in how anger may direct attention, studies have revealed that anger has been both positively associated with concentration disruption (e.g., Allen et al., 2013; McCarthy et al., 2013), and negatively associated with concentration (e.g., Vast et al., 2010) in sports that do not clearly resemble skills where lashing out is necessary or vital for effective performance (e.g., golf, racket sports, soccer, softball).

Dejection is another emotion commonly experienced by athletes during sport performance, but has received limited research attention (Jones et al., 2005). Dejection is closely connected to depressed mood and proposed to be a low intensity negative emotion

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characterised by feelings of deficiency and sadness (Jones et al., 2005). It is likely to arise if one perceives they are not making sufficient expected progress towards meaningful goals, or following actual or perceived failure to achieve a meaningful goal (Frijda, 1994). Though dejection is rarely experienced before competition (e.g., Jones et al., 2005) relative to during competition (e.g., Vast et al., 2010), when dejection is experienced this is likely to impair concentration. Specifically, as dejection (likened to sadness) is a low-approach emotion that arises through an appraisal whereby one perceives failure or that they are not making sufficient progress, this may widen attention and/or direct focus internally towards cognitions irrelevant to the task at hand. Accordingly, athletes report higher levels of pre-performance dejection in relation to poor performance compared to good performance (e.g., Allen et al., 2013). Furthermore, pre-performance dejection has been positively associated with cognitive interference in youth sport players (McCarthy et al., 2013) and concentration disruption in both youth and adult athletes (e.g., Allen et al. 2013; McCarthy et al., 2013). Moreover, in-game dejection has been linked with lower levels of concentration in softball players (e.g., Vast et al., 2010). However, it is yet to be determined how in-game dejection may be associated with cognitive interference in sport.

Two pleasant emotions commonly experienced by athletes are happiness and excitement (e.g., Jones et al., 2005). Happiness refers to a low intensity form of joy that reflects the process of making reasonable progress towards a goal(s) to which one is striving (Lazarus, 2000). Excitement is typically considered a high arousal pleasant emotion and is thought to occur when a person has a positive expectation in their ability to cope and reach a goal(s) or complete a task in challenging situations (Jones, 1995).

Fredrickson's (2001) *broaden-and-build theory* suggests pleasant emotions broaden an individual's momentary mind-set which can aid performance by directing attention to the most relevant resources and cues. However, based on the premises of the *motivational-*



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*dimensional model* (Gable & Harmon-Jones, 2010) high-approach positive affective states (e.g., excitement) narrow attention to facilitate focus on attaining the desired goal, whereas low-approach affective states (e.g. happiness) broaden attentional focus. These propositions would suggest that excitement would be negatively correlated with cognitive interference due to it narrowing attentional focus on relevant cues; although, it remains possible that over-excitement could hinder performance through excessive attentional narrowing. In contrast, although happiness could facilitate the broadening and scope of attention, happiness as a low approach emotion may reflect post-goal attainment resulting in the “easing off” of attentional effort and thereby being drawn to task-irrelevant cues (cf. Gable & Harmon-Jones, 2010).

Studies have shown that pre-performance happiness did not predict cognitive interference when controlling for other emotions (e.g., excitement) (McCarthy et al., 2013), and has been positively associated with concentration disruption in some research (Allen et al., 2013). In contrast, pre-performance excitement has been shown to be negatively associated with concentration disruption and thoughts of escape (McCarthy et al., 2013). In sum, these findings suggest that excitement may be more beneficial for effective information processing during sport performance than happiness. However, more research is required to improve our understanding on the role of pleasant emotions on cognitive interference.

Given that some emotions (e.g., anxiety, anger and happiness) have been somewhat equivocally associated with concentration, it is important to examine their discrete roles on cognitive interference. Moreover, apart from one study which investigated the moderating role of age in youth sport players (McCarthy et al., 2013), research has yet to investigate potential amenable moderators of the emotion-cognitive interference relationship. Appraisal of literature reveals two primary candidates; self-confidence and emotion regulation (e.g., Eysenck & Calvo, 1992; Hanton, Mellalieu, & Hall, 2004; Uphill, Lane, & Jones, 2012).

## **Self-Confidence and Emotion Regulation**

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1           Self-confidence refers to the belief that one can successfully execute a specific  
2 activity (Feltz, 1988) and has been shown to be positively associated with sport performance  
3 across numerous studies (see Woodman & Hardy, 2003). The premises of some theories that  
4 have been applied to explain the anxiety-sport performance relationship suggest that under  
5 conditions of high confidence, anxiety may be facilitative for attentional control and  
6 performance by exerting more goal-directed mental effort (Eysenck & Calvo, 1992).  
7 However, it is when confidence is low that anxiety may be more likely to divert attention  
8 away from relevant information. Thus, when one has reasonable belief in success, this can  
9 reduce attention being drawn towards irrelevant thoughts (e.g., performance worries) when  
10 anxious. Studies suggest that anxiety (e.g., Hanton et al., 2004; Neil, Mellalieu, & Hanton,  
11 2006; Robazza & Bortoli, 2007) and anger (e.g., Robazza & Bortoli, 2007) are interpreted as  
12 being more facilitative for performance when self-confident. Therefore, suggesting that  
13 confidence may have a role to play on how anxiety and anger is interpreted for performance,  
14 and potentially influence the relationship between both anxiety and anger with cognitive  
15 interference. Moreover, given that dejection arises when one perceives they are not making  
16 sufficient progress towards a goal, confidence may promote the provision of resources to  
17 cope and succeed, which reduce the adverse impact dejection may have on cognition.  
18 However, research has yet to investigate the potential moderating role of pre-performance  
19 confidence on the relationships between emotions and cognitive interference.

20           Emotion regulation can be defined as the evocation of thoughts or behaviours that  
21 influence emotions and how people experience or express these emotions (e.g., Richards &  
22 Gross, 2000; Uphill et al., 2014). Though there is a considerable amount of ways that  
23 emotions can be regulated, one prominent and adaptive approach to control emotions is  
24 through reappraisal (Uphill et al., 2012). Specifically, reappraisal is an antecedent focused  
25 form of emotion regulation which reflects a cognitive change that construes a potentially

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emotion-eliciting situation in a way that modifies its emotional impact (Gross & John, 2003). For instance, if an athlete believes they may feel overly anxious before competition, they may adapt the way they perceive the event to reduce the anxiety and/or change the emotions they experience. An example could be an athlete reappraising thoughts such as “I am daunted by the prospect of not performing well against our arch-rivals” to “I feel excited to perform against our rivals”. Accordingly, research has supported that reappraisal can be an effective way for players to cope (e.g., Balk, Adrienne, De Riddler, & Evers, 2013) and perform better (e.g., Brooks, 2014) under pressure situations.

Reappraisal may also influence relationships between emotions and performance related outcomes. Uphill et al. (2012) found that despite unpleasant emotions including anger and dejection being interpreted on average as debilitating for performance, the correlations between reappraisal use and an interpretation of these unpleasant emotions being facilitative were in a positive direction. Thus, it is possible that athletes who employ reappraisal find unpleasant emotions including dejection and anger as less disruptive for cognition than those who do not. Furthermore, Uphill and colleagues (2012) showed that athletes’ interpretation of happiness being facilitative for performance was associated with higher reappraisal use. Taken together, research implies that reappraisal may have moderating effect on relationships between a range of emotions and cognitive interference, however research has yet to address this possibility.

## The Present Study

Previous research has highlighted that some emotions are associated with concentration and performance. However, the association between a range of pre-performance and in-game emotions with cognitive interference in adult athletes has yet to be conducted. Moreover, given the equivocal findings between emotions and indices of attention in previous research, the study of potential variables that moderate these relationships has

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been neglected: self-confidence and reappraisal are likely moderators. To this end, the aim of this research is to address these issues. In Study 1, to extend the only previous study investigating the link between pre-performance emotions and cognitive interference (McCarthy et al., 2013), we tested whether *pre-performance* emotions were associated with cognitive interference, and if any relationships were moderated by self-confidence and reappraisal. In Study 2, we examined whether *in-game* emotions were associated with cognitive interference, and whether self-confidence and reappraisal moderated these relationships.

Informed by the literature reviewed, it is hypothesized that pre-performance and in-game anxiety, dejection and happiness will be positively associated with cognitive interference, whereas excitement will be negatively associated. Due to the previous contradictory evidence, the relationship between anger and cognitive interference was less clear. Though exploratory in nature, any relationships were expected to be stronger for in-game than pre-game emotions due to the closer temporal proximity of in-game emotions with in-game cognitions. We also predicted that both reappraisal and confidence would moderate the relationships between anxiety, anger and dejection with cognitive interference, as well as reappraisal moderating the relationships between happiness and cognitive interference. However, the moderating role of both reappraisal and confidence on the effect of all emotions will be explored. Finally, as confidence and reappraisal are approaches used to facilitate coping resources that may influence how emotions are interpreted (e.g., Hanton et al., 2004; Uphill et al., 2012), we also explored whether these potential moderators (reappraisal, confidence) interact with emotions on relationships with cognitive interference.

## Study 1

### Method

**Participants.** One hundred and five team sport players (58 males, 47 females) with an average age of 20.62 ( $SD = 1.54$ ) years took part in this study. Participants competed in

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hockey (n = 21), soccer (n = 16), rugby (n = 16), lacrosse (n = 15), water polo (n = 9), cricket (n = 7), American football (n = 5), tchouckball (n = 5), volleyball (n = 5), netball (n = 4), and basketball (n = 2) across a range of teams. At the time of data collection participants competed in their respective sport for an average of 7.61 ( $SD = 4.55$ ) years and competed at club (35%), county/ regional (41%), and national/ international (24%) level.

### Measures

**Emotions.** Emotions were measured using the 22-item Sport Emotion Questionnaire (SEQ) (Jones et al., 2005). The SEQ comprises adjectives that measure anxiety (5 items; e.g., “anxious”), anger (4 items; e.g., “annoyed”), dejection (5 items; e.g., “dejected”), excitement (4 items; e.g., “excited”), and happiness (4 items; e.g., “pleased”). Each item was rated following the stem “during the last 10 minutes before my latest sport performance I felt” on a 5-point Likert type scale anchored from 1 (*not at all*) to 5 (*extremely*). Athletes can accurately recall the emotions they experience (e.g., Jokela & Hanin, 1999) and there is psychometric support for the factorial validity and internal consistency ( $\alpha$ 's .77 to .87) for the SEQ to measure emotions experienced retrospectively over a period of time (e.g., over the past month; Arnold & Fletcher, 2015). Therefore, consistent with previous research (e.g., McCarthy et al., 2013), participants were asked to complete the SEQ after a performance rather than immediately beforehand to avoid disrupting participants pre-performance routine. A mean score for each subscale was calculated for analysis. Jones et al. (2005) provided psychometric support for the measure's subscales with alpha coefficients ranging from .81 to .88 in adult athletes from team and individual sports.

**Cognitive Interference.** Cognitive interference was measured using the 17-item Thought Occurrence Questionnaire for Sport (TOQS) (Hatzigeorgiadis & Biddle, 2000). The measure comprises of three subscales; namely, performance worries (6 items; e.g., “about previous mistakes I have made”), task-irrelevant thoughts (5 items; e.g., “about other

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activities”) and thoughts of escape (6 items; e.g., “that I want to quit”). Participants responded to each item in relation to the following stem “During my latest match I had thoughts” on a 7-point Likert type scale anchored from 1 (*almost never*) to 7 (*very often*). A mean score was calculated for each subscale, as well as a mean composite score of all 17 items. Higher scores represent more frequent occurrences of cognitive interference. Hatzigeorgiadis and Biddle (2000) provided psychometric support for each subscale, as well as the composite score of cognitive interference, with alpha coefficients ranging from .78 to .90 in adult athletes from team and individual sport.

**Self-confidence.** Self-confidence was measured using the 5-item subscale from the Competitive State Anxiety Inventory 2-Revised (Cox, Martens, & Russell, 2003). Specifically, players were asked to rate their response to a range of statements in terms how they felt before their latest match on a 5-point Likert scale anchored from 1 (*not at all*) to 5 (*extremely*). An example item is “I felt self-confident”. A mean score of the 5 items was taken. Cox et al. (2003) provided psychometric support for this measure with alpha coefficients ranging from .86 to .91 in adult athletes from team and individual sport.

**Reappraisal.** To measure players’ use of reappraisal to regulate their emotions in sport, the six-item reappraisal subscale from the Emotion Regulation Questionnaire (ERQ; Gross & John, 2003) was used. Specifically, players were asked to complete each item in relation to competing in sport and rate their level of agreement on a 7-point Likert type scale anchored by 1 (*strongly disagree*) to 7 (*strongly agree*). An example item is “When I want to feel less negative emotion (such as sadness and anger), I change the way I think about the situation”. Higher scores represent greater use of reappraisal to regulate emotions whilst participating in their sport. In the context of sport, Uphill et al. (2012) provided psychometric support for this measure, including factorial validity and internal consistency, with an alpha coefficient of .82 in adult athletes from team and individual sports.

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**Procedure.** Following ethical approval from the University ethics committee, participants were approached by one of the investigators at a training session during the competitive season and provided a participant information sheet informing them of the study purpose, that participation was voluntary and anonymity was assured. After signing a consent form, participants were asked to complete the measures described above with reference to their most recent match. All participants reflected on matches that had taken place less than 1 week earlier. Following completion, participants returned the questionnaire directly back to the researcher and were thanked for their participation.

## Results

**Data screening.** Prior to the main analyses, preliminary analysis was conducted to check for outliers and to evaluate the assumptions underlying correlation and regression analyses. Anger and dejection were not normally distributed (i.e., skewness and kurtosis scores were not between -2 and 2), which was a consequence of many participants reporting a score of zero for anger (69% of participants reported zero for all items;  $M = 0.21$ ,  $SD = 0.44$ ) and dejection (84% of participants reported zero for all items;  $M = 0.10$ ,  $SD = 0.34$ ). Consistent with research that had similar findings (e.g., McCarthy et al., 2013), anger and dejection were removed from subsequent analysis. All other variables were normally distributed and there was no evidence of multicollinearity (tolerance  $> .35$ , variance inflation factor  $< 3$ ).

**Descriptive statistics, correlations, and internal consistency.** Descriptive statistics, correlations and internal consistency are shown in Table 1. Mean values reflected on average, athletes experienced “a little” anxiety, and moderately experienced excitement and happiness before the latest performance as well as occasionally had interfering thoughts during performance. Cronbach’s (1951) alpha coefficients were good to very good for all remaining scales.

**Emotions on cognitive interference.** To test whether emotions predicted cognitive interference, and whether self-confidence and reappraisal moderated any relationships, a series of four hierarchical regression analyses were conducted on each of the three subscales as well as the composite score of cognitive interference (i.e., Aiken & West, 1991). The variables were entered in a 4-step process. We entered emotions in Step 1, and self-confidence and reappraisal in Step 2. In Step 3, we included the 2-way interactions of confidence  $\times$  each emotion, confidence  $\times$  reappraisal, and reappraisal  $\times$  each emotion using the product term of each mean centered variable. In Step 4, to explore for any conjunctive moderating effect for confidence and reappraisal we entered the 3-way interaction of confidence  $\times$  reappraisal  $\times$  each emotion using the product term of each mean-centered variable (e.g., Aiken & West, 1991).

As we conducted several regression analyses which may increase the chance of Type I error, an adaptation of Fisher's protected  $t$  test was applied (Cohen, Cohen, West, & Aiken, 2003). Specifically, similar to previous research (e.g., Dewar & Kavussanu, 2011), we only investigated the significance of individual predictors when the  $F$  value of a specific step in a regression was significant. Accordingly, coefficients for interactions are only reported in Table 2 when the  $F$  value for the respective step is significant. However, we have reported the coefficients for the main effects for confidence and reappraisal despite the  $F$  change for Step 2 not being significant in any model.

Emotions accounted for 21% of the variance in performance worries ( $R^2 = .21$ ,  $F_{3,101} = 8.92$ ,  $p < .001$ ), 9% of the variance in task irrelevant thoughts ( $R^2 = .09$ ,  $F_{3,101} = 3.19$ ,  $p = .03$ ), 12% of the variance in thoughts of escape ( $R^2 = .12$ ,  $F_{3,101} = 4.37$ ,  $p < .01$ ), and 19% of the variance in overall cognitive interference ( $R^2 = .19$ ,  $F_{3,101} = 7.85$ ,  $p < .001$ ). Specifically, in each model anxiety was a positive predictor and excitement a negative predictor of cognitive interference and each of its sub-components. Happiness did not predict cognitive



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interference. The  $F$  change in Steps 2, 3 and 4 were not significant in any of the models, thereby no interactions amongst reappraisal, confidence and emotions were noted.

### Discussion

Our findings are similar to those found in youth sport athletes (McCarthy et al., 2013). Higher levels of pre-performance anxiety were associated with more frequent interfering thoughts during performance. In contrast, higher levels of pre-performance excitement were associated with less frequent interfering thoughts during performance, implying that excitement may help protect effective information processing. However, confidence and reappraisal did not moderate any of the relationships between pre-performance emotions and cognitive interference.

It is possible that the role of emotions on cognitive interference and the moderating role of confidence and reappraisal may be less sensitive for pre-performance states compared to in-game emotions. The tendency to use reappraisal to regulate emotion may also depend on context and is not necessarily stable over time (e.g., an athlete may need to employ emotion regulation strategies differently across separate matches) (e.g., Uphill et al., 2012). Moreover, dejection and anger appears to be experienced with higher intensity during than before performance (e.g., Vast et al., 2010). To extend Study 1 we tested to see which in-game emotions predict cognitive interference and if any relationships are moderated by pre-performance confidence, and use of reappraisal during the match. We measured pre-performance rather than in-game confidence to ensure we captured confidence before rather than after emotions were experienced. This approach is conceptually aligned to the temporal sequencing argued in processing efficiency theory (e.g., Eysenck & Calvo, 1992) and suggested in previous research (e.g., Hanton et al., 2004; Neil et al., 2006; Robazza & Bortoli, 2007), whereby confidence acts as a potential moderator on relationships between (in-game) emotions and information processing (or performance).

## Study 2

### Method

**Participants.** One hundred and sixty-six badminton players (108 men, 58 women) with an average age of 32.25 years (S.D = 12.53) across of range of university and club teams took part in this study. Participants competed in the sport for an average of 14.73 years (S.D = 10.99) and competed at club (45%), county/ regional (44%), and national/ international (11%) level.

### Measures.

***Emotions, cognitive interference, reappraisal, and self-confidence.*** Like Study 1, in-game emotions were measured using the SEQ (Jones et al., 2005) but this time participants responded to each item in response to the following stem “during my latest match I felt”.

Although the original SEQ was validated to measure pre-performance emotions, the questionnaire items were developed by asking athletes to retrospectively think about emotions experienced during their latest sport performance. Accordingly, researchers have used the SEQ to assess in-game emotions (e.g., Dewar & Kavussanu, 2011; Vast et al., 2010).

Reappraisal was measured with reference to its use during the most recent match using an adapted version of the ERQ (Gross & John, 2003). An example of an adapted item is “When I wanted to feel less negative emotion (such as sadness and anger), I changed the way I thought about the situation”. Uphill et al. (2012) reported questionable stability for the ERQ subscales potentially due to the fluctuating context of sport whereby the need to use certain emotion regulation strategies may not be consistent over time (i.e., between different matches). A confirmatory factor analysis (Maximum Likelihood) using Stata version 14 on the subscale on the sample in this study revealed significant factor loadings for all items (between .54 to .82) and an excellent model fit,  $\chi^2(9) = 8.613$ ,  $p = .47$ , RMSEA = 0.000, CFI = 1.000, TLI = 1.003, SRMR = 0.028.

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Pre-performance confidence (CSAI-2R; Cox et al., 2003) and in-game cognitive interference (TOQS; Hatgeorgiadis & Biddle, 2000) were measured as per Study 1.

**Procedure.** Prior to data collection, the study was approved by the university research ethics committee. Following informed consent, participants completed the questionnaire battery shortly after a competitive match (i.e., approximately 10-30 minutes) in relation to their most recent match. Participants handed their responses directly back to the researcher and were thanked for their participation.

## Results

**Data screening.** Prior to the main analyses, preliminary analysis revealed two outliers for anger and dejection (values greater than 3 SDs from the mean). Due to the potential impact that outliers can have on results particularly for correlation analyses (Osborne & Overbay, 2004), the outliers were both removed from subsequent analysis. Normality of the data was then checked by examining skewness and kurtosis scores which all lied between -2 and 2 indicating no significant deviation from normality. No evidence of problems with multicollinearity was found (tolerance > .25, variance inflation factor < 4.1).

**Descriptive statistics, correlations, and internal consistency.** Descriptive statistics, correlations and internal consistency are shown in Table 3. Cronbach's (1951) alpha coefficients for dejection, anxiety and excitement reflected acceptable levels of internal consistency, all other measures comprised of good to very good internal consistency. The mean values were similar to those in Study 1, apart for emotions, particularly dejection and anger, which were reported slightly higher in this sample (i.e., during performance).

**Emotions on cognitive interference.** To test whether in-game emotions predicted cognitive interference, and whether reappraisal and confidence moderated any relationships, as in Study 1, a series of four hierarchical regression analyses were conducted (i.e., Aiken & West, 1991). The results of these analyses are presented in Table 4.

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1        **Performance worries.** Emotions accounted for 17% of the variance ( $R^2 = .17$ ,  $\Delta F_{5,158} =$   
 2        6.46,  $p < .001$ ) in performance worries. Anxiety, dejection and happiness were significant  
 3        positive predictors of performance worries. Anger and excitement were not significant  
 4        predictors. Both Step 3 and Step 4 were not significant, therefore no interactions were  
 5        evident.

6        **Task irrelevant thoughts.** Emotions predicted 7% of variance ( $R^2 = .07$ ,  $F_{5,158} = 2.36$ ,  $p$   
 7         $= .04$ ) in task irrelevant thoughts. Specifically, happiness was a significant positive predictor,  
 8        and excitement was a significant negative predictor, of task irrelevant thoughts. Both Step 2  
 9        and Step 3 were not significant in the model. However, the  $F$  change for Step 4 was  
 10       significant which accounted for an additional 9% of variance ( $\Delta R^2 = .09$ ,  $\Delta F_{5,140} = 3.16$ ,  $p = .$   
 11       01). Specifically, significant 3 way interactions for reappraisal  $\times$  confidence  $\times$  excitement and  
 12       reappraisal  $\times$  confidence  $\times$  happiness were revealed. As presented in Figure 1A, excitement  
 13       was a stronger negative predictor of task irrelevant thoughts for those high in reappraisal and  
 14       low in confidence. Moreover, as shown in Figure 1B, happiness was a more salient positive  
 15       predictor of task irrelevant thoughts for players low in both reappraisal and confidence. Thus,  
 16       these findings suggest a moderating effect of reappraisal and confidence on the relationship  
 17       between both in-game excitement and happiness with task irrelevant thoughts.

18       **Thoughts of escape.** Emotions accounted for 19% of variance ( $R^2 = .19$ ,  $F_{5,158} = 7.56$ ,  $p$   
 19        $< .001$ ) in thoughts of escape. Anxiety and dejection were significant positive predictors  
 20       whereas excitement was a significant negative predictor of thoughts of escape. Step 3 was  
 21       significant ( $\Delta R^2 = .12$ ,  $\Delta F_{11,146} = 2.36$ ,  $p = .01$ ) and revealed significant reappraisal  $\times$  dejection  
 22       as well as confidence  $\times$  happiness interactions. Dejection was a stronger positive predictor of  
 23       thoughts of escape for players with lower use of reappraisal compared to those reporting  
 24       higher use of reappraisal. Moreover, happiness was a stronger positive predictor of thoughts  
 25       of escape for those who reported lower confidence.

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**Overall cognitive interference.** Emotions accounted for 17% of the variance in overall cognitive interference ( $R^2 = .17$ ,  $F_{5,158} = 6.65$ ,  $p < .001$ ). Anxiety, dejection and happiness were significant positive predictors whereas excitement was a negative predictor of cognitive interference. No further steps in the regression model were significant.

## Discussion

Findings from Study 2 highlight the role that in-game emotions could play on cognitive interference and underscore the importance of considering the moderating role of confidence and reappraisal. Anxiety, dejection and happiness were positive predictors of cognitive interference during performance. Specifically, all three emotions were positive predictors of interference from performance worries, whereas only anxiety and dejection were positive predictors of thoughts of escape, and only happiness positively predicted task irrelevant thoughts. Moreover, the positive relationship between dejection and thoughts of escape was more pronounced for those lower in reappraisal, and the positive relationship between happiness and task irrelevant thoughts was more salient for players low in both reappraisal and confidence. In addition, confidence also moderated the relationship between happiness and thoughts of escape, whereby this positive relationship was more pronounced for those low in confidence. On the other hand, excitement was a negative predictor of cognitive interference, particularly task irrelevant thoughts and thoughts of escape. Moreover, the negative relationship between excitement and task irrelevant thoughts was more pronounced for individuals high in reappraisal and low in confidence.

## General Discussion

Previous research investigating the link between pre-performance emotions and cognitive interference has only been undertaken in youth sport players. Research has yet to investigate whether in-game emotions predict cognitive interference, or test variables that may moderate these relationships. The purpose of this research was to address these issues by

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investigating whether (a) a range of pre-performance (Study 1) and in-game (Study 2) emotions predicted cognitive interference during competitive sport performance, and (b) examine whether these relationships were moderated by confidence and reappraisal.

### **Unpleasant Emotions and Cognitive Interference**

Anxiety was positively associated with cognitive interference in both studies. Specifically, similar to previous research in youth sport athletes (e.g., McCarthy et al., 2013), pre-performance anxiety positively predicted all dimensions of cognitive interference in Study 1. Moreover, in-game anxiety positively predicted performance worries and thoughts of escape in Study 2, which is in accordance with previous research indicating that in-game anxiety was associated with lower concentration levels (Vast et al., 2010). Taken together, these findings are in line with theoretical perspectives which posit that anxiety can distract attention away from salient performance information towards the processing of information that is unlikely to facilitate performance (Eysenck & Calvo, 1992; Eysenck et al., 2007). Specifically, thoughts not directly associated with the task at hand, concerns about performance failure or thoughts associated with avoidance behaviour. Confidence and use of reappraisal did not moderate the relationships between anxiety and cognitive interference in both studies. Though some scholars have argued that when confidence is high, anxiety may be facilitative for attentional processing (e.g., Eysenck & Calvo, 1992), the lack of moderating effect for confidence in the anxiety-cognitive interference relationships in our research does not support this prediction.

As expected, dejection positively predicted cognitive interference in Study 2. Specifically, these findings suggest that when athletes feel dejected this is associated with having more frequent thoughts relating to performance worries and thoughts of escape. These findings are aligned with previous research showing pre-performance dejection is positively associated with cognitive interference in youth athletes (McCarthy et al., 2013, Study 1),

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concentration disruption (Allen et al., 2013), as well as research showing dejection is negatively associated with concentration (Vast et al., 2010). Interestingly, dejection was not associated with task irrelevant thoughts in our research. Given that dejection reflects a low-approach emotion (cf. Gable & Harmon-Jones, 2010), and feelings of deficiency and sadness that arise from a perceived lack of progress towards a goal (e.g., Frijda, 1994; Jones et al., 2005), dejection may be more likely to arise from deficiency in relation to a task. Accordingly, when dejected it may be expected that attention is broadened and consumed by concerns about not reaching performance objectives (performance worries) and thoughts about not wanting to continue or give up (i.e., thoughts of escape), rather than cognitions irrelevant to the task.

Reappraisal moderated the relationship between in-game dejection and thoughts of escape, whereby dejection was a stronger positive predictor of thoughts of escape for individuals low in the use of reappraisal. These findings suggest that by regulating dejection through the use of reappraisal this may help protect athletes from some disruptive thoughts during competition. Changing how events are appraised may allow more productive goal-directed information processing rather than attending to thoughts of escape (e.g., giving up). There is accumulating evidence that dejection is disruptive to efficient information processing. However, promoting the use of reappraisal (e.g., via cognitive restructuring or positive self-talk) to regulate dejection when it is experienced may help reduce disruptive thoughts.

In-game anger was positively associated with performance worries and thoughts of escape factors of cognitive interference consistent with the literature (e.g., Allen et al., 2013; McCarthy et al., 2013). However, when other emotions were statistically controlled for, anger did not predict any aspect of cognitive interference, implying a negligible association. There are at least two possible explanations for this. First, if appropriately controlled, in some

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instances anger may help direct attention toward task relevant information, particularly if the situation or task aligned to the action tendency such as “lashing out” (e.g., Lazarus, 2000; Woodman et al., 2009). However, if anger is not suitably controlled, or experienced in situations or tasks that are not aligned to its action tendency, this is likely to result in disruptive thought processing and hinder performance (e.g., Lazarus, 2000). Second, anger could be directed towards self-blame that may result in internal cognitions such as berating oneself (e.g., “I am annoyed with myself”), or directed to the blame of others (e.g., an opponent following provocation) that could result in disruptive focus towards irrelevant external information; thus, cognitions not captured by the TOQS. It is for future research to verify such explanations.

## Pleasant Emotions and Cognitive Interference

Excitement negatively predicted cognitive interference in both studies. Specifically, pre-performance and in-game excitement was associated with reduced frequency of irrelevant thoughts and thoughts of escape, and pre-performance excitement was also associated with reduced frequency of performance worries. These findings support propositions based on the motivational dimensional model (Gable & Harmon-Jones, 2010) and are akin to previous research that has also shown excitement to be negatively associated with thoughts of escape and concentration disruption in youth athletes (McCarthy et al., 2013). Interesting, the negative relationship between in-game excitement and task irrelevant thoughts in Study 2 was moderated by an interaction between reappraisal and [pre-performance](#) confidence. Specifically, the negative relationship between excitement and task irrelevant thoughts was more pronounced for individuals high in reappraisal and low in confidence. This may be explained by reappraisal facilitating more positive thought processing when athletes are low in confidence that may elicit more intense feelings of excitement. Conceptually, excitement is thought to arise when a person has a positive expectation in their ability to cope and reach a



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goal(s) or complete a task in challenging situations (Jones, 1995). Therefore, if an athlete is able to reappraise events during performance more positively they may be able to counteract the low confidence by enhancing excitement. In other words, excitement may promote self-belief in the ability to reach a goal or overcome challenging circumstances in the absence of confidence and thereby reduce irrelevant information processing. These findings are aligned to research that highlights the benefits of reappraising anxiety as excitement across a range of pressure inducing tasks, such as public speaking (Brooks, 2014).

In-game happiness was a positive predictor of cognitive interference, particularly in the form of task irrelevant thoughts. These findings are partially supported by previous research showing that the link between happiness and concentration disruption was in a positive direction (Allen et al., 2013). However, other studies tend to find happiness is negligibly associated with cognitive interference and concentration disruption (e.g., McCarthy et al., 2013). The positive relationship between in-game happiness and task irrelevant thoughts was also moderated by an interaction between [pre-performance](#) confidence and in-game reappraisal whereby this relationship was more pronounced for players' low in both reappraisal and confidence. This suggests that experiencing happiness during performance may be disruptive to attention when athletes are low in confidence and less likely to reappraise the emotion. Moreover, a moderating effect of confidence on the relationship between happiness and thoughts of escape was also noted whereby happiness was more strongly associated with more frequent thoughts of escape for individuals' low in confidence. These findings can be explained in light of the motivational–dimensional model (Gable & Harmon-Jones, 2010). Specifically, positive emotions lower in approach motivation such as happiness may broaden attentional focus, which could result in irrelevant information being processed. Accordingly, when athletes do not reappraise happiness to facilitate a more

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conductive emotional state and when low in confidence, this may result in attention becoming more blasé and drawn away from the task.

In Study 1, pre-performance happiness was not associated with cognitive interference. These findings are consistent with previous research investigating pre-performance emotions on cognitive interference and concentration disruption in youth athletes (McCarthy et al., 2013). A possible reason why in-game happiness could potentially be more disruptive to thought processing than pre-performance emotions is that happiness before performance may also be helpful to preserve energy and attentional resources (e.g., Gable & Harmon-Jones, 2010) prior to competition whereas if experienced during performance, and not controlled, may directly result in irrelevant thought processing. Future research should consider re-addressing the role of pre-performance vs. in-game happiness on attention and performance.

It is worth noting that based on the interactions for pleasant emotions (see Figure 1), most frequently reported irrelevant thoughts were in players reporting low excitement and confidence, and high reappraisal use, or when in athletes reporting low confidence and reappraisal use, and high happiness. The potential reason for this is that confidence and excitement may be associated with less frequent irrelevant thoughts, however if athletes use reappraisal to experience more positive emotion in the form of happiness rather than excitement, or do not reappraise happiness when experienced, it is possible that this is associated with more frequent irrelevant thoughts. In other words, these findings suggest it may be more facilitative for athletes who use reappraisal to experience excitement rather than happiness. It is for further research to confirm these suggestions.

## Applied Implications

The findings presented in this paper imply that athletes may benefit from forms of emotion control training (e.g., reframing, cognitive restructuring) (see Jones, 2003). Strategies to reduce experiences of dejection, and regulate the intensity of anxiety and

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happiness during performance may help reduce the likelihood of interfering thoughts during competition. Alternatively, strategies that can help athletes reappraise experiences or symptoms of anxiety into feelings of excitement should help concentration. Brooks (2014) recently showed that reappraisal of anxiety provoking situations as exciting through self-statements such as “I am excited” or “get excited” was more beneficial for performance than “trying to relax or stay calm”.

Pre-performance confidence and in-game reappraisal use were found to moderate some of the relationships between in-game emotions and cognitive interference, specifically for dejection and happiness. Accordingly, athletes would benefit from applying appropriate confidence building approaches (e.g., self-talk, imagery) prior to performance and developing their ability to reappraise emotions during performance by learning to effectively apply cognitive behavioural strategies.

## Limitations and Future Research Directions

Although this research has provided some novel findings there are of course some limitations that should be considered. Performance was not assessed in the two studies, so we assume that cognitive interference had a negative effect on performance outcome. Both studies were cross-sectional, so the causal direction of relationships cannot be determined. Similar to previous studies of emotion (e.g., Dewar & Kavussanu, 2011; McCarthy et al., 2013; Vast et al., 2010), participants were asked to reflect on emotions across specified points or periods of time (i.e., 10 minutes before the latest match or during the latest match, respectively). As emotions are transient and likely to fluctuate, we cannot say with any certainty that specific intensities of emotions, or combinations of emotions, temporarily aligned to occurrences of cognitive interference. We also measured pre-performance confidence in both studies to control the temporal sequencing of confidence as a moderator of the relationships between emotions and cognitive interference. Though confidence may not

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1 be expected to be as transient as emotions, it is of course possible that confidence could  
2 fluctuate during a match (e.g., Vealey, 2001). Experimental investigation would afford the  
3 more direct examination of the effects of confidence, emotion inductions, and emotion  
4 regulation strategies on attentional processes, and in turn, their impact on sport-specific  
5 performance.

6 Self-report allows researchers to measure participants' subjective experience of  
7 emotions and assess attentional processing in real-world contexts without impacting on  
8 participant performance preparation by completing the measures after, rather than just before  
9 or during performance. Moreover, research has supported that emotions in sport can be  
10 reliably recalled in time periods up to a month (e.g., Arnold & Fletcher, 2015). That said, it is  
11 possible that results were impacted by recall bias. To advance research in the field, multi-  
12 measure approaches to the assessment of emotion (e.g., observations of facial expression,  
13 psychophysiological indices of emotion) and attention (e.g., EEG, active recall from  
14 observations) as part of experimental or longitudinal research designs should be considered.

15 Apart from one previous study that investigated the moderating role of age on the  
16 emotion-concentration relationship in youth athletes, to our knowledge, this is the only other  
17 research that has investigated potential moderators of this relationship, and the first in adult  
18 sport performers. Given the complexity of how some emotions may influence concentration,  
19 it is unlikely that our test of potential moderators was exhaustive. Appraising emotion-  
20 concentration relationships through other theoretical lenses (e.g., Jones, Meijen, McCarthy, &  
21 Sheffield, 2009) could identify other potential moderators to trial. Finally, this study focused  
22 on cognitive interference and did not examine other potentially disruptive thought patterns  
23 including external distractions or thoughts directed towards conscious processing of  
24 movements. Given that emotions, particularly anxiety, have been argued to play a role on  
25 such attentional processes (e.g., Eysenck et al., 2007; Masters & Maxwell, 2008), researchers

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1 may wish to further explore how an array of emotions can influence other forms of disruptive  
2 thoughts not captured by cognitive interference.

### 3 **Conclusion**

4 To conclude, this research demonstrated that emotions can play a role in cognitive  
5 interference in sport. Specifically, anxiety, dejection and, to an extent, happiness were  
6 positive predictors, and excitement a negative predictor, of aspects of cognitive interference.  
7 Moreover, reappraisal and confidence moderated some relationships between in-game  
8 emotions and cognitive interference. These findings provide a range of applied implications  
9 in terms of highlighting how pre-performance and in-game emotions are associated with  
10 interfering thoughts. Finally, such research underscores the importance of investigating how  
11 emotions can influence attention during sport performance, as well as the need to consider  
12 variables that moderate these relationships.

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Table 1. Descriptive Statistics, correlations and internal consistency for Study 1 (N=105)

	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	9	10
1. Anxiety	1.56	0.87	(.84)								
2. Excitement	2.83	0.68	.17	(.72)							
3. Happiness	2.27	0.86	.05	.63**	(.82)						
4. Performance worries	2.74	0.97	.39**	-.13	-.01	(.74)					
5. Irrelevant thoughts	2.09	1.13	.19	-.14	.01	.47**	(.88)				
6. Thoughts of escape	1.45	0.61	.16	-.25*	-.09	.59**	.57**	(.83)			
7. Cog. Interference	2.09	0.74	.31**	-.21*	-.04	.84**	.83**	.82**	(.89)		
8. Reappraisal	4.16	1.05	-.01	.13	-.01	-.03	-.15	-.02	-.08	(.84)	
9. Confidence	2.59	0.74	-.05	.43***	.24*	-.25**	-.08	-.30**	-.24*	.20*	(.87)

Note: Emotions and self-confidence were measured on a 1-5 scale, and cognitive interference and reappraisal were measured on a 1-7 scale. \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ .

## Emotion and Cognitive Interference

Table 2. Regression analyses for pre-performance emotions on cognitive interference in Study 1 ( $N = 105$ ).

Emotion	Performance worries		Irrelevant thoughts		Thoughts of escape		Cognitive interference (total)	
	<i>b</i> (se)	$\beta$	<i>b</i> (se)	$\beta$	<i>b</i> (se)	$\beta$	<i>b</i> (se)	$\beta$
Step 1								
Anxiety	.48 (0.10)	.44***	0.30 (0.13)	.23*	0.15 (0.07)	.21*	0.31 (0.08)	.37***
Excitement	-.44 (0.17)	-.31**	-0.49 (0.21)	-.29*	-0.33 (0.11)	-.37**	-0.43 (0.13)	-.39**
Happiness	.18 (0.13)	.16	0.24 (0.16)	.18	0.10 (0.09)	.14	0.16 (0.10)	.18
Step 2								
Reappraisal	.04 (0.08)	.04	-0.12(0.11)	-.12	0.03 (0.06)	.06	-0.00 (0.07)	-.00
Confidence	-.24 (0.13)	-.18	0.05(0.17)	.04	-0.17 (0.09)	-.28*	-0.13 (0.10)	-.13

Note. \* $p < .05$ , \*\* $p < .01$ , \*\*\*  $p < .001$ .

## Emotion and Cognitive Interference

Table 3. Descriptive Statistics, correlations and internal consistency for Study 2 ( $N=164$ )

	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10
1. Anxiety	2.00	0.67	(.78)									
2. Anger	1.81	0.61	.23**	(.68)								
3. Dejection	1.62	0.48	.28**	.56**	(.66)							
4. Excitement	3.24	0.74	.24**	-.05	-.21**	(.68)						
5. Happiness	3.28	0.78	.12	-.23**	-.29**	.56**	(.76)					
6. Performance worries	2.71	0.80	.29**	.19*	.31**	-.03	.07	(.63)				
7. Irrelevant thoughts	1.86	0.81	.09	-.03	.01	-.08	.14	.35**	(.80)			
8. Thoughts of escape	1.45	0.48	.22**	.25**	.39**	-.17*	-.10	.34**	.53**	(.71)		
9. Cognitive interference	2.02	0.54	.27**	.17*	.29**	-.10	.07	.79**	.80**	.73**	(.81)	
10. Reappraisal	4.17	1.09	.11	.09	.03	.13	.19*	-.03	.12	-.02	.04	(.85)
11. Self confidence	3.14	0.78	-.14	-.10	-.10	.36***	.22**	-.10	-.07	-.13	-.10	.00

Note: Emotions and self-confidence were measured on a 1-5 scale, and cognitive interference and reappraisal were measured on a 1-7 scale. \* $p < .05$ ,

\*\*  $p < .01$

## Emotion and Cognitive Interference

Table 4. Regression analyses for in-game emotions on cognitive interference in Study 2 ( $N = 164$ ).

	Performance worries		Irrelevant thoughts		Thoughts of escape		Cognitive interference (total)	
	<i>b</i> (se)	<i>B</i>	<i>b</i> (se)	$\beta$	<i>b</i> (se)	$\beta$	<i>b</i> (se)	$\beta$
Step 1								
Anxiety	.26 (0.10)	.22**	0.15 (0.10)	.12	0.11 (0.06)	.16*	0.18 (0.06)	.22**
Anger	.03 (0.12)	.03	−0.01(0.13)	−.01	0.04 (0.07)	.05	0.03 (0.08)	.03
Dejection	.45 (0.16)	.27**	−0.00 (0.17)	−.00	0.31 (0.09)	.31**	0.26 (0.10)	.24*
Excitement (Excite)	−.14 (0.10)	−.13	−0.29 (0.11)	−.26**	−0.12 (0.06)	−.19*	−0.18 (0.07)	−.25**
Happiness (Happ)	.20 (0.09)	.20*	0.28 (0.10)	.27**	0.06 (0.06)	.09	0.17 (0.06)	.25**
Step 2								
Self Confidence (Conf)	−.05 (0.08)	−.05	−0.02(0.09)	−.01	−0.02 (0.05)	−.03	−0.03 (0.06)	−.04
Reappraisal	−.07 (0.06)	−.09	0.07 (0.11)	.08	−0.00 (0.03)	−.01	−0.01 (0.04)	−.01
Step 3								
Conf*Happiness					−0.25 (0.08)	−.34**		
Reappraisal*Dejection					−.37 (0.10)	−.39***		
Step 4								
Reappraisal*Conf*Excite			−0.44 (0.16)	−.36**				
Reappraisal*Conf*Happ			0.26 (0.12)	.33*				

Note. Only significant interactions for regression steps that were also significant are reported in the table. \* $p < .05$ , \*\* $p < .01$ , \*\*\*  $p < .001$

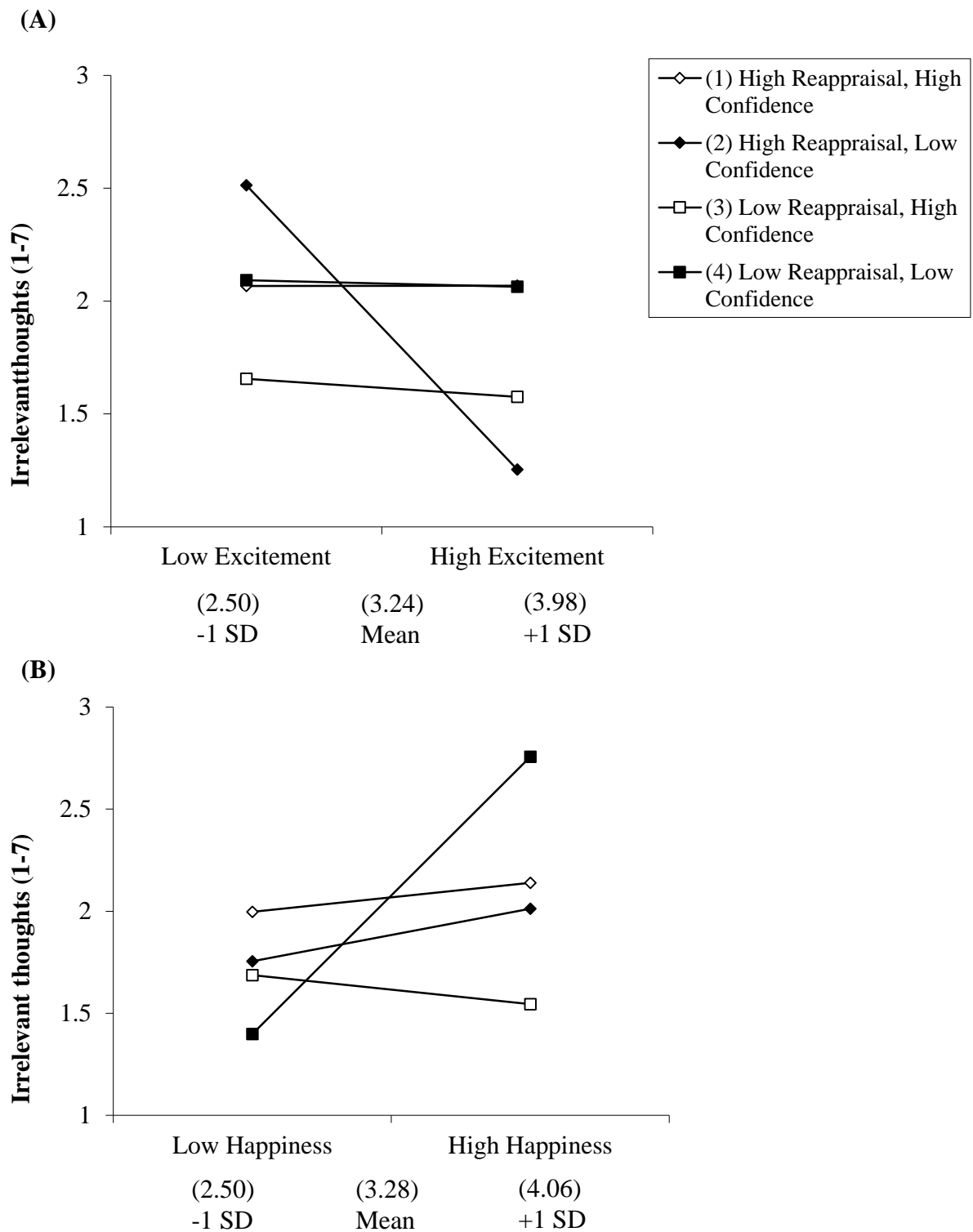


Figure 1. The moderating effect of reappraisal and confidence on the relationship between a) in-game excitement and task irrelevant thoughts (Panel A) and b) in-game happiness and task irrelevant thoughts (Panel B) in Study 2.